APPENDIX A

Formulas For Water Supply Problems

USE OF FORMULAS TO SOLVE PROBLEMS

This appendix gives formulas for use in solving water supply problems often found in the field. Each formula is accompanied by a problem solved by using the formula.

CONVERSION OF VOLUME TO WEIGHT OF WATER

The formula and a problem for conversion of volume to weight of water are given below.

a. Formula.

Weight of water in pounds = Cubic feet of water x 62.4

b. Illustrative Problem. What is the weight of water in a full tank with a volume of 470 cubic feet?

Weight of water = Cubic feet x 62.4

= 470 x 62.4

= 29,328 pounds

CONVERSION OF VERTICAL FEET OF WATER TO POUNDS PER SQUARE INCH

The formula and a problem for conversion of vertical feet of water to pounds per square inch are given below.

a. Formula.

Pounds per square inch = Vertical feet of water x 0.43

b. Illustrative Problem. What is the pressure in pounds per square inch at the bottom of a storage tank with 25 vertical feet of water?

Pounds per square inch = Vertical feet of water x 0.43

= 25x 0.43

= 10.75

CONVERSION OF POUNDS PER SQUARE INCH TO VERTICAL FEET OF WATER

The formula and a problem for conversion of pounds per square inch to vertical feet of water are given below.

a. Formula.

Vertical feet of water= Pounds per square inch = 2.3

b. Illustrative Problem. How many vertical feet of water are in a tank that is 45 feet high? A pressure gauge at the bottom of the tank reads 9 pounds per square inch.

Vertical feet of water = Pounds per square inch x 2.3

= 9 x 2.3

= 20.7

CONVERSION OF VOLUME TO GALLONS OF WATER

The formula and a problem for conversion of volume to gallons of water are given below.

a. Formula.

Gallons of water= Cubic feet of water x 7.5

b. Illustrative Problem. How many gallons of water are in a tank with 400 cubic feet of water?

Gallons of water = Cubic feet of water x 7.5

= 400 x 7.5

= 3.000

CONVERSION OF GALLONS OF WATER TO CUBIC FEET

The formula and a problem for conversion of water to cubic feet are given below,

a. Formula

$$\text{Cubic feet} = \frac{\text{Gallons of water}}{7.5}$$

b. Illustrative Problem. How many cubic feet of tank space are needed to store 1,500 gallons of water?

$$\text{Cubic feet} = \frac{\text{Gallons of water}}{7.5}$$

$$= \frac{1,500}{7.5}$$

$$= 200$$

CALCULATION OF VOLUME OF WATER TANKS

The formula and two problems for calculation of volume of water tanks are given below.

a. Formula for Rectangular Tank

$V = L \times W \times H.$

where V = Volume in cubic feet

L = Length in feet

W = Width in feet

H = Height in feet

b. Formula for Cylindrical Tank.

$V = \pi r^2 H$

where V = Volume in cubic feet

π = 3.14 or 22/7, a constant

r = Radius (half of the diameter) of the tank

H = Height in feet

c. Illustrative Problems. What is the volume of a rectangular tank that is 10 feet long, 7 feet wide, and 4 feet high?

$V = L \times W \times H$

$= 10O \times 7 \times 4$

$= 280$ cubic feet

What is the volume of a cylindrical tank that has a radius of 4 feet and is 7 feet high?

$V = \pi r^2 H$

$= 3.14 \times 4^2 X\ 7$

$= 3.14 \times 16 \times 7$

$= 351.68$ cubic feet

CALCULATION OF QUANTITY OF WATER FLOWING IN A STREAM

The formula and a problem for calculation of quantity of water flowing in a stream are given below.

a. Formula.

$Q = 6.4 \times A \times V$

where Q = Quantity of water in gallons per minute

6.4 = Constant.

There are 7.5 gallons of water per cubic foot. However, because of error in stream measurement, 7.5 is reduced to 6.4.

V = Velocity of the stream in feet per minute.

This figure is obtained by noting the time it takes a twig or floating object to travel a known distance.

A = Area of the stream in square feet.

This figure is obtained by multiplying the width of the stream by the depth of the stream.

b. Illustrative Problem. A stream has an average depth of 2 feet and a width of 16 feet. A twig floats 13.3 feet per minute. How many gallons per minute are flowing in the stream?

$Q = 6.4 \times A \times V$

$= 6.4 \times 2 \times 16 \times 13.3$

$= 2{,}732.8$ gallons per minute

CALCULATION OF POUNDS OF CHLORINE

The formula and a problem for calculation of pounds of chlorine are given below.

a. Formula.

$$\text{Pounds of chlorine} = \frac{\text{Gallons of water} \times 8.3 \times \text{parts per million}}{1{,}000{,}000}$$

b. Illustrative Problem. If eight parts per million of chlorine are required for 3,000 gallons of water, how many pounds of chlorine will be needed?

$$\text{Pounds of chlorine} = \frac{\text{Gallons of water x 8.3 x parts per million}}{1{,}000{,}000}$$

$$= \frac{3{,}000 \times 8.3 \times 8}{1{,}000{,}000}$$

$$= 0.1992$$

CALCULATION OF GALLONS OF WATER THAT CAN BE TREATED WITH A GIVEN SUPPLY OF CHLORINE

The formula and a problem for calculation of' gallons of water that can be treated with a given supply of chlorine are given below.

a. Formula.

$$\text{Gallons of water} = \frac{\text{Pounds of chlorine x 1,000,000}}{\text{8.3 x parts per million}}$$

b. Illustrative Problem. There are 4.15 pounds of chlorine on hand. The operator is using five parts per million of chlorine as the average treatment dosage. How many gallons of water can the operator treat before running out of chlorine?

$$\text{Gallons of water} = \frac{\text{Pounds of chlorine x 1,000,000}}{\text{8.3 x parts per million}}$$

$$= \frac{4.15 \times 1{,}000{,}000}{8.3 \times 5}$$

$$= 100{,}000$$

CALCULATION OF THE PARTS PER MILLION OF CHLORINE PRESENT IN A TREATMENT TANK

The formula and a problem for calculation of parts per million of chlorine present in a treatment tank are given below.

a. Formula.

$$\text{Parts per million} = \frac{\text{Pounds of chlorine x 1,000,000}}{\text{Gallons of water x 8.3}}$$

b. Illustratiue Problem. If 16.6 pounds of chlorine are added to 20,000 gallons of water, how many parts per million of chlorine are present?

$$\text{Parts per million} = \frac{\text{Pounds of chlorine x 1,000,000}}{\text{Gallons of water x 8.3}}$$

$$= \frac{16.6 \times 1{,}000{,}000}{20{,}000 \times 8.3}$$

$$= 100$$

CONVERSION OF POUNDS OF CHLORINE TO OUNCES OF CALCIUM HYPOCHLORITE

The formula and a problem for conversion of pounds of chlorine to ounces of calcium hypochlorite are given below.

a. Formula.

Ounces of calcium hypochlorite = Pounds of chlorine x 22.9

b. Illustrative Problem. If 1/2 pound of chlorine will be needed to treat a water source, how many ounces of calcium hypochlorite will be required?

Ounces of calcium hypochlorite = Pounds of chlorine x 22.9
= 0.5 x 22.9
= 11.45